

offers comforts far beyond those to which they have been accustomed. But supplying these needs does not fulfil all the requirements of relief; sympathy, encouragement, and religious ministrations may be added with advantage in a sanitary point of view, irrespective of other and higher objects. For this part of the hygienic management the physicians must depend in a great measure on others. And here is a field for philanthropic labour which lacks husbandmen. How few of the many who are earnest to benefit their fellows think of the sick and friendless poor in hospitals, where, by judicious words and offices of kindness, they might reap a harvest of good works, of which least in importance, although important, is the favourable influence on the course of disease! But I am entering on a train of thought which, for the medical reader, offers nothing new and is not called for, and I therefore here rest my remarks on hygiene in disease.

With this article I take leave of the subject of *Conservative Medicine*. In my first article I endeavoured to show that the term conservatism expresses the great feature of medicine of the present time, and a governing principle in medical practice. In my second article I considered the principle of conservatism as applied to therapeutics. In this third article I have offered a few fragmentary thoughts on the application of this principle to hygiene. With the rise and progress of conservatism we see a great, almost a radical change in practical medicine. This change is a legitimate result of the progress of knowledge. It is not to be expected that medicine is to be stationary; unchangeableness is incompatible with progress. There must be changes if medicine be progressive. Bearing in mind these truths, it is the part of every true physician to try to keep pace with the advancement of the profession.

ART. VI.—*On Sunstroke*. By HORATIO C. WOOD, JR., M. D., Resident Physician to the Pennsylvania Hospital.

DURING the heated term of our summers, several classes of cases of what is termed sunstroke are without doubt developed. In this paper but one of these is considered, no other having come under the notice of the writer.

CASE 1. J. B., Irishman, æt. about 30, was brought into the ward at 1 P. M., August 2, 1863. He was said to have fallen whilst walking in the street a few minutes before. He was perfectly unconscious, with very laboured breathing. His pupils were not markedly dilated or contracted, and yielded sluggishly to light. His skin was cyanosed and very hot and dry. He had vomited and passed his feces unconsciously. His pulse was

140, quick and moderately strong. He could scarcely swallow. Turpentine injections and brandy were exhibited, but he died at 5 P. M.

Autopsy two hours after death.—Rigor mortis marked. Venous trunks of the meninges of the brain loaded with dark blood. Brain substance not abnormal. Lungs congested. Heart rigidly contracted. A thermometer in thorax indicated 108° F.¹ Blood not coagulating, very dark coloured, with a slightly acid reaction. Sp. gravity 1059. 1205 grs. of blood evaporated yielded 550 grains of dry solid matter. 158 grs. of blood yielded 43 grs. of dry impure albumen. Blood corpuscles under the microscope normal, excepting that they were very dark coloured.

CASE 2. P. M., Irishman, æt. 64, a moderately stout, muscular man, was brought into wards about 7 P. M., August 10th. His skin was very hot; belly tympanitic; pulse 177, not intermittent, but very weak. He had involuntary discharges; also strange contortions of the face, owing to spasms of the muscles pretty regularly repeated at the rate of 130 times a minute. He was treated with turpentine injections, brandy, aromatic spirits of ammonia, &c. He died quietly about 11½ P. M.

*Autopsy one hour after death.*²—Brain with venous trunk of the meninges loaded with blood. Substance normal, not congested. No bloody or serous effusions. Capillaries of the lungs scarcely congested at all, but the blood pouring out of the veins when cut. Heart rigidly contracted. Kidneys normal. Thermometer in abdominal cavity 108° F. Blood very dark and fluid. Sp. gravity 1050. Reaction very slightly acid.

CASE 3. G. G., German, a soldier who had served out his time, æt. about 35, intemperate, a very large robust man weighing apparently 200 lbs. He was brought into the wards of the hospital about 1 P. M., August 10, 1863. Those that brought him in said that he had fallen suddenly whilst loading a dray about an hour and a half previous to his admission. When he was carried into the ward his skin was of a dark reddish tint, the capillaries refilling very slowly after being emptied by pressure with the fingers, requiring several seconds to do so. His pulse was 170 and upwards, very irregular and intermittent, but not excessively weak or thready. He was utterly unconscious, but laid perfectly still, without even *subsultus tendinum*. His pupils were contracted. The conjunctiva not sensitive and very much congested. His skin exemplified, *calor mordax*. A thermometer placed in his axilla indicated 109° F. His breathing was slow and very laboured and irregular. He had involuntary discharges of feces. All these symptoms grew worse and worse, his skin darkened; breathing became slower and slower; pulse failed, and before death, which occurred about 2½ P. M., dirty foam trickled down from his nose and mouth. He died quietly without convulsions.

Treatment.—Frictions with ice, brandy and ammonia as much as could be forced down him. Turpentine injections.

Autopsy one hour after death.—Cadaver very hot, no rigor mortis. Meninges of the brain with the large venous trunks loaded with blood. Brain substance normal, no exudation of blood or serum. Walls

¹ Three thermometers were compared and found to agree in these cases, so that there can be no doubt as to the reliability of the observations.

² Most of the autopsies previously reported were made 8—10 hours after death. In a cadaver at the high temperature of these bodies there must be putrefactive changes in that space of time.

of the abdomen and thorax with the abdominal contents loaded with fat. Lungs with their capillaries and venules not congested, but from their larger veins the blood poured freely. Heart slightly concentrically hypertrophied, very firmly contracted. Kidneys normal. Liver fatty. Bladder empty, very firmly contracted on itself. Blood very dark coloured, fluid, showing some slight indications of coagulating, but not forming more than a very few shreds.

CASE 4. C. H., apparently an Englishman, over 60, was brought into the wards of the hospital at 1½ P. M. (Aug. 11). He was said to have fallen whilst walking along the street, between one and two hours previously. When brought in he was very restless, almost convulsive; breathing laboured and noisy; pulse 170, and slightly intermittent; skin intensely hot, a thermometer in his axilla indicating 109° F. He could only swallow a teaspoonful at a time and that with difficulty. His pupils were contracted and conjunctiva dry, non-sensitive, and injected. There was some stasis in the capillaries of the skin, but it was not strongly pronounced.

Brandy, aromatic spirits of ammonia, and turpentine injections were exhibited; he was also rubbed with ice, but died in half an hour.

Autopsy one hour after death.—Cadaver very fat. Meninges of the brain with their venous trunks distended with very dark blood. Substance not strikingly congested. Ventricles distended with a large amount of slightly reddish serum. No effusion of blood. Heart slightly hypertrophied, firmly contracted. Lungs with their capillaries free from congestion, but the blood pouring from the veins when cut. Liver in a state of fatty degeneration. Kidneys normal. Spleen very much enlarged and softened. Bladder empty, rigidly contracted on itself. Blood very dark, coagulating, but not so firmly as normal.

CASE 5. P. B., Irishman, only a few days in this country. He was said to have fallen during the latter part of the afternoon, Aug. 11, whilst wheeling coal on Smith's Island, in the Delaware.

He states that he had drunk freely of ice-water, but had not sweated any; that he had no premonitory symptoms—no signs of exhaustion, no optical phantasma, no alteration of colour of surrounding objects, no headache, etc. When brought in (9 P. M.), he was in a state of semi-consciousness, but could scarcely speak intelligibly; his pulse was moderately strong, 90 per minute; surface dry, but not inordinately hot; he had no pain, but complained of great weakness; he apparently had not had involuntary discharges.

Treatment.—R. Ammoniae muriat. gr. x; Sp. frumenti f3ss; Aquæ f3j, every half hour, and an injection of an ounce of turpentine.

At 10½ P. M. his pulse had fallen to 80, and his general condition much improved. Ordered his medicine to be given every hour only.

August 12th he was entirely conscious, but very drowsy, and slept a great deal. August 14th he had entirely recovered, and regained his strength.

CASE 6. J. B., an intemperate Irishman, æt. about 33, was brought into the ward 3½ P. M., Aug. 14, 1863. His wife stated that on the 10th of the month he was exhausted with the heat, sick at his stomach, with a terrible headache, etc., so that he was forced to give up work until the morning of the 14th. When he entered the ward, his skin was moist, but

hot, and covered with a rubeoloid eruption. A thermometer between the thighs indicated 104° F. His pupils were slightly contracted; his conjunctiva was injected, but very sensitive; he had not had (as far as could be ascertained) involuntary discharges. His pulse was 140, rather feeble; he was entirely unconscious, but muttering to himself unintelligibly, and very restless. He vomited freely.

Treatment.—Cold water poured by the bucketful over head and breast, turpentine injections.

At 4 o'clock his restlessness was replaced by convulsions, with opisthotonos. These convulsions lasted some five or six minutes each, and were somewhat epileptiform; but as there was no saliva he did not foam at the mouth, although his jaws worked violently; his breathing was for the most part very hurried, shallow, and irregular, but occasionally laboured and slow. He passed a few drops of urine, and the injection operated on his bowels. Brandy was attempted to be exhibited, but it always brought on immediately fearful convulsions, probably owing to the difficulty of deglutition. The cold effusions lowered the temperature of the skin, but did not resuscitate him in the least.

At $4\frac{1}{2}$ o'clock the douche was repeated, but this time threw him into violent spasms, with vomiting, and great congestion of face. From this time his symptoms deepened, his body became very dark blue or purplish, and he died quietly at quarter past five. No post-mortem could be obtained. This case differed somewhat from the others—was the previous exhaustion the cause?

CASE 7. An Irishman, æt. apparently 40, a stout, muscular, but not fat man, was brought into the wards Aug. 14th, about 8 P. M. He was said to have fallen about 3 o'clock. When he was carried in, he was perfectly unconscious, somewhat restless, with *subsultus tendinum*, as well as more decided muscular twitchings. His tongue was very dry, his skin was dry and harsh, hot, but not so excessively so as in some cases. A thermometer in his axilla indicated 104° F.; his pupils were slightly dilated; conjunctiva injected; pulse 150, weak, not intermittent, but somewhat fluttering; breathing 48 per minute, and very laborious; he could swallow only with difficulty. Before he came in, he had had mustard sinapisms on legs, stomach, etc.

Ordered brandy $f\bar{3}ij$, immediately.

At 9 P. M. his condition was unchanged, excepting that his pulse was more fluttering and marked. Ordered brandy $f\bar{3}j$ every half hour.

His symptoms went on from very bad to worse, and he died quietly about $11\frac{1}{2}$ P. M.

Autopsy one hour after death.—No rigor mortis. Meninges of the brain, with their large venous trunks full of dark blood. Substance of the brain very slightly, if at all, congested. Ventricles with considerable serum in them. No effusion of blood. Lungs with their capillaries not congested, but the blood pouring from their veins when cut across. Heart rigidly contracted, walls somewhat thickened, and very firm. Liver very large and fatty. Kidneys somewhat congested. Thermometer in abdominal cavity 106° F. Blood very dark and fluid, with a decidedly acid reaction.

CASE 8. C. B., German, a large and very muscular man, was brought into hospital about $12\frac{1}{2}$ P. M., August 15th. His skin was very hot and dry; a thermometer in axilla indicating 109° F.; he had passed his feces invo-

luntarily, and a little urine after his admission; his pupils were about normal in size; conjunctiva injected; mouth moist; deglutition almost impossible; he had a severe convulsion shortly after his entrance, and died in less than an hour. There was a large ecchymosis in one axilla. He fell whilst working in a sugar refinery where the heat was intense, and was brought immediately to the hospital.

Autopsy two hours after death.—Meninges of the brain, with their veins filled with blood. Some serous exudation in ventricles, but scarcely more than normal. Lungs with their capillaries not congested, but the blood pouring from their veins when cut across. Heart rigidly contracted. Liver very fatty, with its veins loaded with blood. Thermometer in abdomen indicating $110\frac{3}{4}^{\circ}$ F. Blood decidedly acid, very fluid, without a sign of coagulation; under the microscope, the red globules were possibly a little more opaque than normal, and aggregated in rouleaux and masses. No abnormal proportion of white corpuscles.

Remarks.—Sunstroke is often preceded by well-marked prodromes. Dr. Swift speaks of subjective optical sensations, of all surrounding objects being coloured, and Dr. Taylor (*Lancet*, 1858) of a violent and peculiar pain in the hypogastric region as being frequently present in their cases before the attack.

Case 5 is the only one in which I have been able to make any observations on this point. This patient was questioned repeatedly and very carefully as to any unnatural feelings, any sense of exhaustion preceding his attack, and his answers were so consistent as to establish the fact that there was in him nothing whatever to give intimation of what was about to happen, except it were great thirst and diminished excretions. When an individual falls, he does so suddenly, and instantly loses all knowledge, either of the surrounding world or of the microcosm within. If he recovers, that period is a total blank in his remembrance. In the fully formed disease, the unconsciousness is perfect, but reflex action is not suspended, at least in most cases. I have seen convulsions excited by an attempt to administer brandy, and sometimes touching the conjunctiva will produce violent contractions of the muscles of the face. Convulsions occur frequently, and may be very severe. Every manifestation of disordered cerebro-spinal action, from subsultus tendinum to eclampsia, takes place. One case had been subject to epilepsy, yet he had no convulsions whilst in the wards of the hospital. The skin is frequently cyanosed, and sometimes has ecchymosis beneath it. A better example of calor mordax is seldom seen, and the thermometer indicates a remarkably high temperature. The range in an instrument placed in the axilla has been in our cases from 104° to 109° F. In the body which manifested the last degree a thermometer, placed in the abdomen shortly after death, showed $110\frac{3}{4}^{\circ}$ F. The cases in which the greatest altitude is reached, are those where there is the greatest destruction of the blood crasis. The pulse is very rapid and quick, and often, in the earlier portion of the attack, not devoid of force.

The pupils in the early stage are mostly moderately contracted, and are either insensible to light or respond very sluggishly to it. As death approaches they often become widely dilated. The conjunctiva is always more or less injected and dry, and sometimes insensible to the touch. The tongue may be dry and chapped, or it may be moist. In some individuals the salivary glands secrete a dark abnormal saliva—in others, they cease their work. The breathing is always laborious, very generally rapid as well as deep, and, in many instances, it is evident that there is no paralysis of the phrenic nerve, that the lungs are ready to do their share in depurating the blood, and that the non-oxygenated condition of the life fluid is owing to what Virchow denominates paralysis of the red corpuscles. Vomiting almost always takes place; watery bilious matter, with the contents of the stomach, being rejected. The renal secretion appears to be entirely suspended. It would be very interesting to know whether it was so before the attack or no. But as liquid involuntary discharges from the bowels took place in most of the cases before admission, it was impossible to judge. A few drops of urine were passed by one or two whilst in the ward. The probability is, that the function of the kidney is very materially diminished, but not altogether suppressed before the affection manifests itself. I have not seen hemorrhages from any mucous surface, but see no reason why they may not occur. These symptoms generally grow worse and worse, the patient weaker and weaker, and the case runs on to a fatal termination. The approach of death, although rapid, is insidious. Convulsions, when present, subside, and the end is brought on by loss of power in the central nervous system. Very rarely recovery takes place. Then the symptoms subside, the pulse falls, and life begins to dawn on the patient. The return of consciousness is slow, and unpleasant sequelæ are said sometimes to occur, but in the case in this hospital the patient in forty-eight hours was perfectly recovered.

The results of the autopsies were both negative and positive. There was a total absence of all inflammatory products, or any signs of active congestion. The blood was found very fluid, dark coloured, with an acid reaction, and a loss of its power of coagulating. The *heart* was, in all the cases, *rigidly contracted*. The veins were surcharged with blood. Must not the symptoms of this malady be owing to one of the three following causes: 1. Inflammation or active congestion. 2. Nervous exhaustion. 3. Morbid condition of the blood. That it is not owing to the first, the autopsies abundantly certify. Exhaustion is manifested by general loss of power, accompanied by relaxation of the whole system, a feeble, although it may be quick pulse, and a cool, moist skin and disturbed sensorium. There may be, indeed, apparent strength, but this is merely simulated, and is characterized by convulsions, jactitation, and great restlessness. If the symptoms of uncomplicated mania-a-potu, which may be taken as the

type of the class, are examined, is not this description seen to be correct? Is not a hot, dry skin present in any supposed case of delirium tremens an unerring indication of the existence of more than that disease? Is it not significant of the presence of some inflammation or blood-poison? Further, is not exhaustion gradual in its approaches? How, then, can the suddenness of the attack and the hot, dry skin be reconciled with the idea of nervous exhaustion? Is it at all consistent with the character of the latter class of diseases, that a man, strong and robust, should one moment be in full vigour, and the next, utterly without warning, be stricken down as by a flash of lightning? In an autopsy after fatal exhaustion, flabby muscles and a worn-out heart would be the lesions naturally looked for. The nervous system has a wonderful influence over the whole economy, but in what simple nervous disease are changes wrought in the blood? The blood is frequently abnormal, but as a preceding, not consequent phenomenon of the nervous disorder. It seems utterly foreign to all the present knowledge of the pathology of the nervous system, that nervous prostration should in a few hours totally destroy the coagulability and alkalinity of the blood.

If sunstroke be not owing to inflammation nor yet to exhaustion, it must be due to some alteration in the blood. Now, what class of people are most obnoxious to blood diseases? The unacclimated and intemperate. Who are almost the only persons attacked by *coup de soleil*? The unacclimated and intemperate. How do blood diseases commence? Most generally they are preceded by prodromes, but very frequently they develop in an instant their full force. Witness scarlatina maligna, pernicious fever, &c. What obstetrician has not seen his patient, previously without a bad symptom, perhaps whilst he is congratulating her on her safe delivery, instantaneously seized with a convulsion? How does sunstroke begin? Most generally prodromes presage its coming, but frequently its victim is stricken down utterly without warning. After the first manifestations of a blood disease, there is generally a paroxysm of fever. So is there in *coup de soleil*. For could any set of symptoms agree more thoroughly with Prof. Wood's definition of fever, which is as follows [*Practice of Medicine*, vol. i. p. 90]: "Fever is an acute affection, in which all the functions are more or less deranged; the most striking phenomena being sensorial or nervous irregularity, increased frequency of pulse, increased heat, and disinclination for food." Ecchymoses are characteristic of an altered blood. They occur in sunstroke. There is also an odour peculiar to this malady which finds its analogue among the blood affections. Scarlatina maligna, puerperal convulsions, &c., occasionally prove as rapidly fatal as sunstroke. Finally, the pathognomonic post-mortem results of a fatal blood disorder are alteration and destruction of the crasis of the life-fluid, without structural change in the solids. This is precisely what is found after death from *coup de soleil*.

The true pathology of the disease appears, then, to be as follows : The excessive heat causes a suspension of the functions of the excretory glands, and produces changes in the life-fluid probably more than the simple retention of effete material. These alterations in the blood are trifling at first, but are progressive, so that in a short time some agent or agencies are evolved capable of producing the fearful cerebral symptoms. The name of "sunstroke" is very indefinite, and if the pathology advocated in this paper is correct, thermohæmia or thermic fever would be more in accordance with the modern system of nomenclature.

The preventive treatment of this malady is, of course, to avoid the cause. But there is a popular prejudice, that drinking cold water is injurious. This in former times was held by the farmers around the city, and it was thought necessary to guard the water with ginger, &c. But all this has been abandoned, and ice water is now used *ad libitum* through the country. The cause of this prejudice is probably that the commencing blood changes and great heat of the body create excessive thirst. If the glandular system can be kept active, there is much less danger to be apprehended ; and is not water a powerful stimulant to the secretions ? Is it reasonable, that water should be withheld from a system whose blood is being deprived of its serum, it may be, by pints, through the perspiratory glands ?

The treatment of the fully developed disease has been in our hands utterly futile. The case that dia recover would have done so if nature had been left to herself ; in all the others, the condition of the blood, when brought in, precluded all hope. I know of no agent that will check directly the tendency to degradation of the life-fluid. The regular treatment in this hospital is to give a turpentine injection, and administer stimulants. Both of which are in most cases of no avail. The indications are first to check the changes in the blood, and secondly, support the system. But unless the first can be fulfilled, the second is useless. Dr. Taylor (*loc. cit.*) states, that he did not lose a case during April, 1852, when many were stricken down with well-marked symptoms, and when he practised cold affusions, water being poured on them continuously, until they showed signs of returning consciousness. This result is so wonderful as to make one doubt whether there is not some difference in the disease as seen in the East Indies and in this country. But the plan certainly ought to be tried, as it may possibly check chemical change by reducing the temperature, and at the worst can only be equally hopeless with all the others.